CLAIMS

1. A fully redundant linearly expandable router (100), comprising:

a first router component (102), said first router component (102) including a first routing engine (144) having input and output sides and a second routing engine (152) having input and output sides;

a second router component (104), said second router component (104) including a third routing engine (178) having input and output sides and a fourth routing engine (186) having input and output sides;

a third router component (106), said third router component (106) including a fifth routing engine (212) having input and output sides and a sixth routing engine (220) having input and output sides;

a first link (110), said first link (110) coupling said input side of said first routing engine (144) to said input side of said third routing engine (178);

a second link (112), said second link (112) coupling said input side of said first routing engine (144) to said input side of said fifth routing engine (212);

a third link (116), said third link (116) coupling said input side of said third routing engine (178) to said input side of said fifth routing engine (212);

a fourth link (122), said fourth link (122) coupling said input side of said second routing engine (152) to said input side of said fourth routing engine (186);

a fifth link (124), said fifth link (124) coupling said input side of said second routing engine (152) to said input side of said sixth routing engine (220); and

a sixth link (128), said sixth link (128) coupling said input side of said fourth routing engine (186) to said input side of said sixth routing engine (220);

wherein said first, third and fifth routing engines (144, 178 and 212) and said second, fourth and sixth routing engines (152, 186 and 220) are arranged in respective fully connected topologies.

2. The apparatus of claim 1, wherein:

said first, second, third, fourth, fifth and sixth routing engines (144, 152, 178, 186, 212 and 220) each have N inputs to said input side thereof and M outputs from said output side thereof;

said N inputs to and said M outputs from said second routing engine (152) are redundant of said N inputs to and said M outputs from said first routing engine (144);

said N inputs to and said M outputs from said fourth routing engine (186) are redundant of said N inputs to and said M outputs from said third routing engine (178);

said N inputs to and said M outputs from said sixth routing engine (220) are redundant of said N inputs to and said M outputs from said fifth routing engine (212);

said linearly expandable router formed from said first, second, third, fourth, fifth and sixth routing engines (144, 158, 178, 186, 212 and 220) having 3N inputs and 3M outputs.

3. The apparatus of claim 2, wherein:

said first link (110) provides said N inputs to said first routing engine (144) to said input side of said third routing engine (178) as a first N additional inputs thereto and provides N inputs to said third routing engine (178) to said input side of said first routing engine (144) as a first N additional inputs thereto;

said second link (112) provides said N inputs to said first routing engine (144) to said input side of said fifth routing engine (212) as a first N additional inputs thereto and provides N inputs to said fifth routing engine (212) to said input side of said first routing engine (144) as a second N additional inputs thereto;

said third link (116) provides said N inputs to said third routing engine (178) to said input side of said fifth routing engine (212) as a second N additional inputs thereto and provides said N inputs to said fifth routing engine (212) to said input side of said third routing engine (178) as a second N additional inputs thereto;

said fourth link (122) provides said N redundant inputs to said second routing engine (152) to said input side of said fourth routing engine (186) as a first N additional redundant inputs thereto and provides said N redundant inputs to said fourth routing engine (186) to said input side of said second routing engine (152) as a first N additional redundant inputs thereto;

said fifth link (124) provides said N redundant inputs to said second routing engine (152) to said input side of said sixth routing engine (220) as a first N additional redundant inputs thereto and provides said N redundant inputs to said sixth routing engine (220) to said input side of said second routing engine (158) as a second N additional redundant inputs thereto; and

said sixth link (128) provides said N redundant inputs to said fourth routing engine (186) to said input side of said sixth routing engine (220) as a second N additional redundant

inputs thereto and provides said N redundant inputs to said sixth routing engine (220) to said input side of said fourth engine (186) as a second N additional redundant inputs thereto.

4. The apparatus of claim 1, and further comprising:

a fourth router component (108), said fourth router component (108) including a seventh routing engine (246) having input and output sides and an eighth routing engine (254) having input and output sides

a seventh link (114), said seventh link (114) coupling said input side of said first routing engine (144) to said input side of said seventh routing engine (246);

an eighth link (118), said eighth link (118) coupling said input side of said third routing engine (178) to said input side of said seventh routing engine (246);

a ninth link (120), said ninth link (120) coupling said input side of said fifth routing engine (212) to said input side of said seventh routing engine (246);

a tenth link (126), said tenth link (126) coupling said input side of said second routing engine (152) to said input side of said eighth routing engine (254);

an eleventh link (130), said eleventh link (130) coupling said input side of said fourth engine (186) to said input side of said eighth routing engine (254);

a twelfth link (132), said twelfth link (132) coupling said input side of said sixth routing engine (220) to said input side of said eighth routing engine (254);

wherein said first, third, fifth and seventh routing engines (144, 178, 212 and 246) and said second, fourth, sixth and eighth routing engines (152, 186, 220 and 254) are arranged in respective fully connected topologies.

5. The apparatus of claim 4, wherein:

said first, second, third, fourth, fifth, sixth, seventh and eighth routing engines (144, 152, 178, 186, 212, 220, 246 and 254) each have N inputs to said input side thereof and M outputs from said output side thereof;

said N inputs to and said M outputs from said second routing engine (152) are redundant of said N inputs to and said M outputs from said first routing engine (144);

said N inputs to and said M outputs from said fourth routing engine (186) are redundant of said N inputs to and said M outputs from said third routing engine (178);

said N inputs to and said M outputs from said sixth routing engine (220) are redundant of said N inputs to and said M outputs from said fifth routing engine (212);

said N inputs to and said M outputs from said eighth routing engine (254) are redundant of said N inputs to and said M outputs from said seventh routing engine (246);

said linearly expandable router formed from said first, second, third, fourth, fifth, sixth, seventh and eighth routing engines (144, 158, 178, 186, 212, 220, 246 and 254) having 4N inputs and 4M outputs.

6. The apparatus of claim 5, wherein:

said first link (110) provides said N inputs to said first routing engine (144) to said input side of said third routing engine (178) as a first N additional inputs thereto and provides N inputs to said third routing engine (178) to said input side of said first routing engine (144) as a first N additional inputs thereto;

said second link (112) provides said N inputs to said first routing engine (144) to said input side of said fifth routing engine (212) as a first N additional inputs thereto and provides N inputs to said fifth routing engine (212) to said input side of said first routing engine (144) as a second N additional inputs thereto;

said third link (116) provides said N inputs to said third routing engine (178) to said input side of said fifth routing engine (212) as a second N additional inputs thereto and provides said N inputs to said fifth routing engine (212) to said input side of said third routing engine (178) as a second N additional inputs thereto;

said fourth link (122) provides said N redundant inputs to said second routing engine (152) to said input side of said fourth routing engine (186) as a first N additional redundant inputs thereto and provides said N redundant inputs to said fourth routing engine (186) to said input side of said second routing engine (152) as a first N additional redundant inputs thereto;

said fifth link (124) provides said N redundant inputs to said second routing engine (152) to said input side of said sixth routing engine (220) as a first N additional redundant inputs thereto and provides said N redundant inputs to said sixth routing engine (220) to said input side of said second routing engine (158) as a second N additional redundant inputs thereto;

said sixth link (128) provides said N redundant inputs to said fourth routing engine (186) to said input side of said sixth routing engine (220) as a second N additional redundant inputs thereto and provides said N redundant inputs to said sixth routing engine (220) to said input side of said fourth engine (186) as a second N additional redundant inputs thereto;

said seventh link (114) provides said N inputs to said first routing engine (144) to said input side of said seventh routing engine (246) as a first N additional inputs thereto and provides said N inputs to said seventh routing engine (246) to said input side of said first routing engine (144) as a third N additional inputs thereto;

said eighth link (118) provides said N inputs to said third routing engine (178) to said input side of said seventh routing engine (246) as a second N additional inputs thereto and provides said N inputs to said seventh routing engine (246) to said input side of said third routing engine (178) as a third N additional inputs thereto;

said ninth link (120) provides said N inputs to said fifth routing engine (212) to said input side of said seventh routing engine (246) as a third N additional inputs thereto and provides said N inputs to said seventh routing engine (246) to said input side of said fifth routing engine (212) as a third N additional inputs thereto;

said tenth link (126) provides said N inputs to said second routing engine (152) to said input side of said eighth routing engine (254) as a first N additional redundant inputs thereto and providing said N redundant inputs to said eighth routing engine (254) to said input side of said second routing engine (152) as a third N additional redundant inputs thereto;

said eleventh link (130) provides said N inputs to said fourth routing engine (186) to said input side of said eighth routing engine (254) as a second N additional redundant inputs thereto and provides said N redundant inputs to said eighth routing engine (254) to said input side of said fourth routing engine (186) as a third N additional redundant inputs thereto; and

said twelfth link (132) provides said N redundant inputs to said sixth routing engine (220) to said input side of said eighth routing engine (254) as a third N additional redundant inputs thereto and providing said N redundant inputs to said eighth routing engine (254) to said input side of said sixth routing engine (220) as a third N additional redundant inputs thereto.

7. A fully redundant linearly expandable broadcast router (100), comprising:

at least three broadcast router components (102, 104, 106), each of said at least three broadcast router components (102, 104, 106) having a first router matrix (102a, 104a, 106a) and a second router matrix (102b, 104b, 106b);

means (110, 112, 116) for coupling said first router matrices (102a, 104a, 106a) of said at least three broadcast router components (102, 104, 106) in a first fully connected topology; and

means (122, 124, 128) for coupling said second router matrices (102b, 104b, 106b) of said at least three broadcast router components (102, 104, 106) in a second fully connected topology.

8. The apparatus of claim 7, wherein:

each one of said first router matrices (102a, 104a, 106a) further comprises a routing engine (144, 178, 212) coupled between input and output sides thereof; and

each one of said second router matrices (102b, 104b, 106b) further comprises a routing engine (154, 186, 220) coupled between input and output sides thereof.

9. The apparatus of claim 8, wherein said routing engine (144, 178, 212, 154, 186, 220) for each one of said first and second router matrices (102a, 104a, 106a, 102b, 104b, 106b) has N inputs coupled to said input side thereof.

10. The apparatus of claim 9, wherein said N inputs to said routing engine (154) of a first one (102b) of said second router matrices (102b, 104b, 106b) is redundant of said N inputs to said routing engine (144) of a first one (102a) of said first router matrices (102a, 104a, 106a).

11. The apparatus of claim 10, wherein said N inputs to said routing engine (186) of a second one (104b) of said second router matrices (102b, 104b, 106b) is redundant of said N inputs to said routing engine (178) of a second one (104a) of said first router matrices (102a, 104a, 106a).

12. The apparatus of claim 11, wherein said N inputs to said routing engine (220) of a third one (106b) of said second router matrices (102b, 104b, 106b) is redundant of said N inputs to said routing engine (212) of a third one (106a) of said first router matrices (102a, 104a, 106a).

13. A method of constructing a fully redundant linearly expandable broadcast router (100), comprising:

providing first, second, third, fourth, fifth and sixth router matrices (102a, 102b, 104a, 104b, 106a and 106b), each having input and output sides;

coupling, using a first discrete link (110), said input side of said first router matrix (102a) to said input side of said third router matrix (104a);

coupling, using a second discrete link (112), said input side of said first router matrix (102a) to said input side of said fifth router matrix (106a);

coupling, using a third discrete link (116), said input side of said third router matrix (104a) to said input side of said fifth router matrix (106a);

coupling, using a fourth discrete link (122), said input side of said second router matrix (102b) to said input side of said fourth router matrix (104b);

coupling, using a fifth discrete link (124), said input side of said second router matrix (102b) to said input side of said sixth router matrix (106b); and

coupling, using a sixth discrete link (128), said input side of said fourth router matrix (104b) to said input side of said sixth router matrix (106b).

14. The method of claim 13, and further comprising:

providing seventh and eighth router matrices (108a and 108b), each having input and output sides;

coupling, using a seventh discrete link (114), said input side of said first router matrix (102a) to said input side of said seventh router matrix (108a);

coupling, using an eighth discrete link (118), said input side of said third router matrix (104a) to said input side of said seventh router matrix (108a);

coupling, using a ninth discrete link (120), said input side of said fifth router matrix (106a) to said input side of said seventh router matrix (108a);

coupling, using a tenth discrete link (126), said input side of said second router matrix (102b) to said input side of said eighth router matrix (108b);

coupling, using an eleventh discrete link (130), said input side of said fourth router matrix (104b) to said input side of said eighth router matrix (108b); and

coupling, using a twelfth discrete link (132), said input side of said sixth router matrix (106b) to said input side of said eighth router matrix (108b).